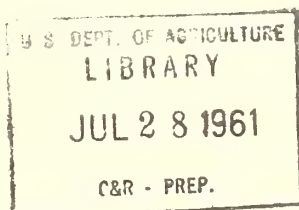


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Output per Man-Hour and Labor Costs in Food Processing



MARKETING ECONOMICS DIVISION
ECONOMIC RESEARCH SERVICE
U. S. DEPARTMENT OF AGRICULTURE

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OUTPUT PER MAN-HOUR AND LABOR COSTS IN FOOD PROCESSING 1/

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:
: Output per man-hour by all employees in factories that process :
: domestic farm food products grew at an average annual rate of 2.9 :
: percent from 1947 to 1960. This is significantly smaller than the :
: annual rate for the total private economy, but the same as that for the :
: private nonfarm sector. Output per man-hour in farming rose more :
: than twice as fast as in food processing industries; this difference can be :
: explained by the fact that substitution of capital for labor was larger in :
: farming than in food processing industries. :
:
:
: The postwar rise in output per man-hour in factories that process :
: farm foods reflects an increase in total capital per worker, improved :
: "quality" of labor and management inputs, economies of scale and, :
: probably most important, the introduction of new technology. The :
: postwar rate of growth was significantly retarded by shifts in output :
: among industries. Shifts occurred from industries with higher levels :
: of output per man-hour to those with lower levels. :
:
:
: In the food processing industries, hourly earnings of employees :
: increased during 1960. They were about four-fifths larger that year :
: than the average for 1947-49. But because of the gains in output per :
: man-hour unit labor costs were up less than a third for the period. The :
: percentage increase in unit labor costs was about the same as the :
: general price rise in the total economy. :
:

A preliminary estimate indicates that during 1960 output per man-hour worked by all employees in factories processing domestic farm food products was 40 percent greater than the average for 1947-49 (table 10). This means that roughly seven-tenths as many man-hours per unit of output are required in factory processing now as were required a dozen years ago. 2/ Production per man-hour

rose each year after 1948 (fig. 1), but year to year increases varied widely. Factory production of processed farm foods rose almost continuously after 1948-- in 1960 it was 33 percent greater than the average for 1947-49. During those years the total number of man-hours worked by all employees fluctuated about a fairly constant or slightly declining level.

1/ Prepared by William H. Waldorf, economist, Marketing Economics Division, Economic Research Service. Index numbers used in this article were developed as part of a broad investigation of changes in productivity of resources employed in marketing domestic farm food products. A more comprehensive report, including a discussion of methods, sources, and limitations of the indexes will be published as Technical Bulletin 1243, Output Per Man-Hour in Factory Processing of Farm Food Products.

2/ The reciprocal of output per man-hour used in this article measures changes in unit man-hour requirements for a changing product "mix."

Table 1.--Production, man-hours, production per man-hour, hourly earnings per employee, and unit labor cost in factories processing farm foods, United States, 1947-60 1/
(1947-49 = 100)

	Production <u>2/</u>	Man-hours <u>3/</u>	Production per man-hour	Hourly earnings <u>4/</u>	Unit labor cost <u>5/</u>
1947	101	101	99	94	94
1948	99	100	99	101	103
1949	100	99	102	105	103
1950	103	99	104	110	106
1951	106	101	105	121	115
1952	108	102	106	127	120
1953	112	<u>6/</u> 97	<u>6/</u> 115	<u>6/</u> 134	<u>6/</u> 117
1954	113	97	117	140	119
1955	117	98	119	145	122
1956	124	100	124	152	123
1957	124	98	126	158	126
1958	126	97	130	166	128
1959	130	<u>7/</u> 96	<u>7/</u> 136	<u>7/</u> 174	<u>7/</u> 128
1960	<u>7/</u> 133	<u>7/</u> 96	<u>7/</u> 139	<u>7/</u> 181	<u>7/</u> 130

1/ Excludes processing of fluid milk, cream, and eggs.

2/ Measures physical output of manufacturing establishments processing domestically produced farm food products; includes food byproducts.

3/ Based on all employees and average hours worked, as defined in Census of Manufactures.

4/ Total payroll divided by man-hours (col. 2).

5/ Total payroll divided by production (col. 1).

6/ Revised sampling plan in Annual Survey of Manufactures beginning in 1953 somewhat affects comparability with earlier years. Comparison of employment data reported in Annual Surveys and by the Bur Labor Stat. suggests that average annual rate of growth in output per man-hour from 1947 to 1959 was not significantly affected by the revision.

7/ Preliminary.

Compiled from Census of Manufactures, Annual Surveys of Manufactures, and data published by U. S. Dept. Agr. Employment, hours, and earnings data published by U. S. Dept. Labor also used for several years.

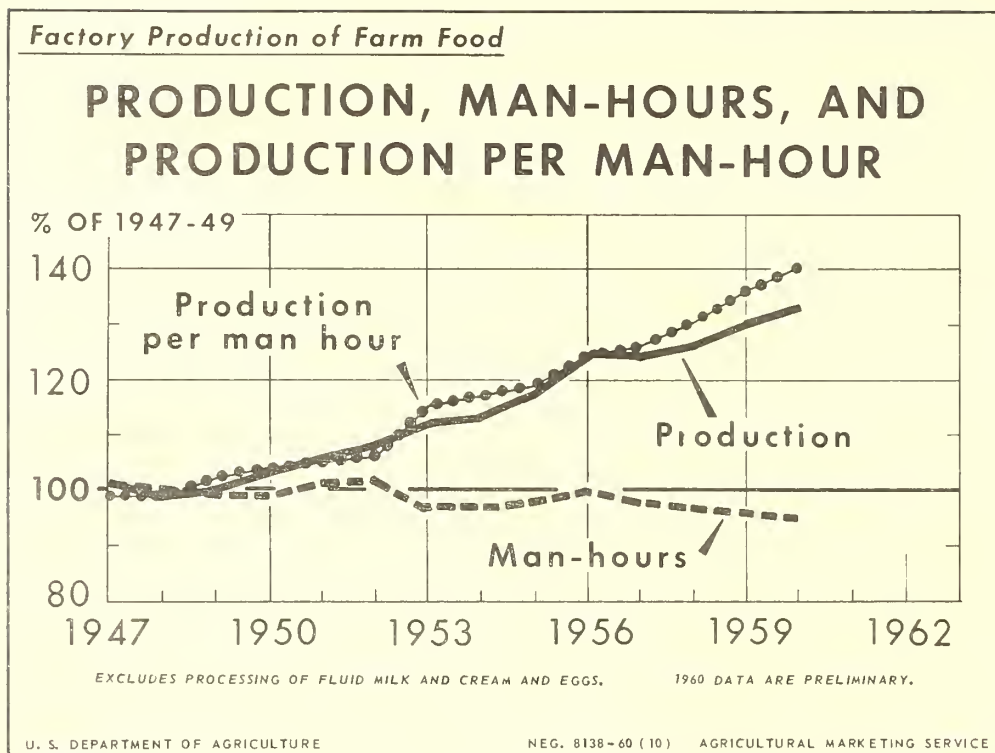


Figure 1

Series used in this article are for manufacturing establishments primarily engaged in processing domestically produced farm food products, including factory processing of farm foods--except fluid milk, cream and eggs--for export, for the Armed Forces, and for Govern-

ment purchases used in various relief programs, as well as food for sale to civilian consumers. It excludes factory processing of imported foods, seafoods, and other foods not produced on domestic farms. It also excludes manufacture of alcoholic and nonalcoholic beverages.

Comparison With Other Sectors 3/

The average annual rate of growth in output per man-hour worked by all employees between 1947 and 1959 was significantly smaller in factories processing farm food products (2.8 percent) than in the total private economy (3.4 percent). The larger rate in the total private economy resulted from a large annual rate in farming (6.2 percent); in the private nonfarm sector, which includes

manufacturing, trade, and service industries, output per man-hour rose at the same yearly rate (2.8 percent) as in food processing industries.

The dramatic rate of growth of output per man-hour in agriculture reflects, among other things, a large substitution of capital for labor in farming. The value of assets per worker (in 1947-

3/ The average annual rates of growth of output per man-hour worked by all employees in the private economy, in agriculture, and in the private nonagricultural sector were computed from Bur. Labor Stat. annual estimates reported in *Trends in Output Per Man-Hour in the Private Economy, 1909-58*, BLS Bull. 1249 (1959), and BLS release, *Output Per Man-Hour in the Private Economy, 1959*, U. S. Dept. Labor-4155 (June 20, 1960). All average annual rates of growth presented in this article were obtained by fitting exponential curves by least squares (Glover's method) to annual data.

49 prices) used in farm production was nearly 70 percent greater in 1960 than in 1947, according to the Economic Research Service. This increase was con-

siderably larger than the rise in total capital per worker in food manufacturing, and accounts for the faster rate of growth of output per man-hour in farming than in food processing.

Factors Affecting Output Per Man-Hour

The postwar rise of output per man-hour in factory processing was accompanied by an increase in the stock of total capital per worker. However, technological improvement in capital goods probably was the most important single factor contributing to the growth in output per man-hour. Technological innovations in materials handling, continuous processes, electronic temperature and humidity controls, packaging, grading, and other developments have all made a dramatic impact on output per man-hour. Growth of kilowatt hours of electric power used reflects, among other things, the employment of more electric power-driven equipment required by newer technology. Between 1947 and 1958, the number of kilowatt hours consumed in food manufacturing plants rose about 50 percent compared with a rise of about 25 percent in the production of food. Development of frozen foods, blended and prepared flour mixes, and other new products in which output per man-hour either is higher, or is rising faster than the average for all processed foods, also contributed to the overall increase in output per man-hour.

Increases in the "quality" of labor inputs through education, training, experience, and other kinds of investment in human capital also added substantially to the growth in output per man-hour. During the postwar period, the number of engineers, technicians, and other highly trained employees who worked in food processing plants increased significantly. ^{4/} Economies of scale resulting from extension of the market for processed

farm foods probably also contributed significantly to the postwar growth in output per man-hour.

The index of output per man-hour in factory processing reflects shifts in production among industries, plants, products, and, in general, all possible changes in the product "mix." Shifts in production from industries with higher levels, to industries with lower levels of output per man-hour moderated the rate of growth in the average output per man-hour for the food processing industries during the postwar period. If the 1947 (or 1957) product mix had remained constant during the postwar years, output per man-hour in food processing industries would have grown at about the same yearly rate as in the total private economy (3.4 percent). Thus, within the limits of available data, there is no evidence that the postwar rise in output per man-hour within individual food processing industries or plants was larger or smaller than the average for the total private economy.

Changes in the product mix will continue for some time to exert a dampening influence on the growth of output per man-hour in factories processing farm food products. Income elasticities for farm foods estimated by the Economic Research Service indicate that as "real" per capita income rises (other things remaining the same) consumers shift to meat products, for which output per man-hour is currently below the average for all processed foods, and from grain-mill products, for which output per man-hour is currently above the average. ^{5/} To

^{4/} See, Scientific Workers in Food Manufacturing Industries, by Imogene Bright, this issue pp. 33-36.

^{5/} Fox, Karl A., "Factors Affecting Farm Income, Farm Prices, and Food Consumption," U. S. Dept. Agr., Agricultural Economics Research, 3:65-86, 1951.

some extent, these dampening influences will be tempered by a shift to manufactured dairy products where both income elasticity and output per man-hour are high compared with the average for all

processed foods. Among the other major groups--bakery products, fruits and vegetables, and sugar and confectionery products--output per man-hour is roughly the same as the average for all processed farm foods.

Unit Labor Cost

Hourly earnings of employees in factories processing farm food products (based on hours worked by all employees) were about 80 percent higher in 1960 than in 1947-49; but, because of the rise in output per man-hour, unit labor costs were 30 percent above the base period figure (table 10). During the postwar period, hourly earnings have moved continuously upward and, since 1951, at a sharp and constant rate (fig. 2). Production per man-hour rose each postwar year except one, but at a markedly slower pace than hourly earnings. As a consequence, unit labor cost has risen, particularly since 1953.

The sharp rise in hourly earnings was not confined to food manufactures; it was part of a sharp postwar increase in all manufactures. The large increase in hourly earnings reflects, among other things, inflationary price and wage rises in the economy as a whole: The implicit price deflator for gross national product constructed by Department of Commerce, the most comprehensive price series available, rose about 30 percent between 1947-49 and 1959. Comparison of the price deflator with the rise in hourly earnings in food processing between 1947-49 and 1959 (table 10), indicates that roughly half of the rise in hourly

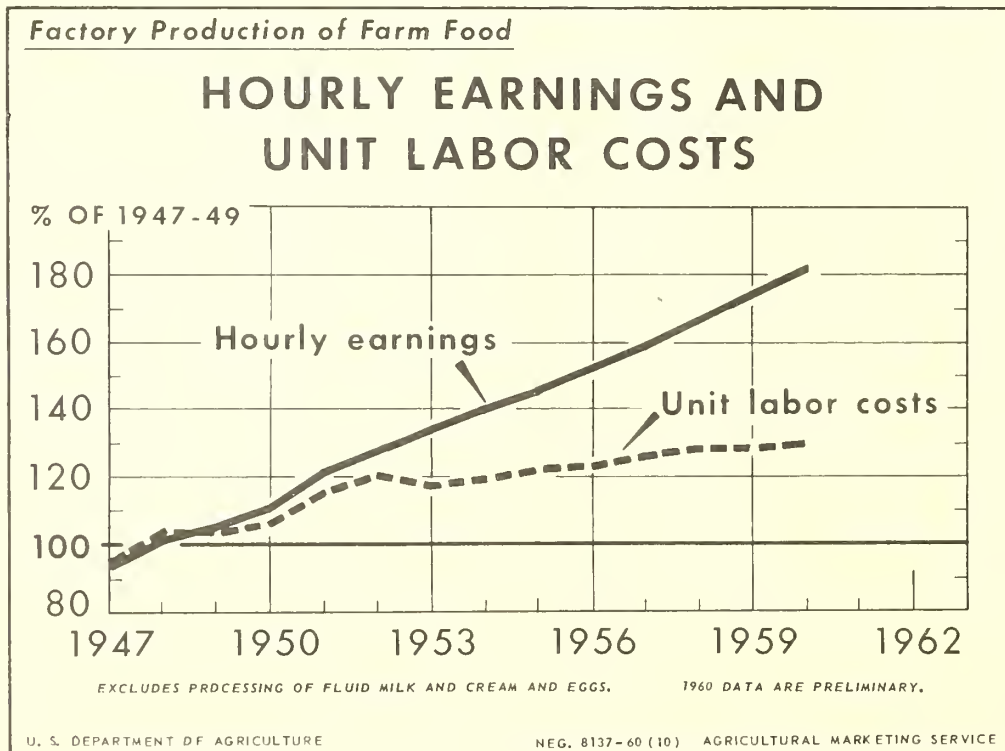


Figure 2

earnings can be attributed to the general price rise. The remaining half resulted from a shift to more technical, higher paid jobs which increased the all-employee average, and from "normal" market forces which require food manufacturers to pay competitive wages in order to attract and hold employees. The noninflationary growth in hourly earnings in food processing from 1947-49 to 1959, was about the same as the growth of output per man-hour. This suggests that if there had been no overall inflation, unit labor cost in food processing industries would have remained constant during the postwar years.

Nonlabor charges (profits, taxes, depreciation, advertising, and other oper-

ating expenses) per unit of output in factory processing rose faster than unit labor cost from 1947-49 to 1958, the latest year for which these data are available. ^{6/}

The larger increase in nonlabor charges in food processing reflects the substitution of capital, technology, and other production inputs for labor; and it also reflects larger outlays for advertising and similar operating expenses. Total unit processing charges, the sum of unit labor and nonlabor charges, were about a third larger in 1958 than in 1947-49. This rise increased the spread between wholesale prices of processed food products and prices paid to farmers for the raw materials.

^{6/} Nonlabor charges are measured by subtracting total payrolls for all employees from "value added," reported in Census and Annual Surveys of Manufactures. Value added, as used in the Census of Manufactures, is "calculated by subtracting the cost of materials, supplies, containers, fuel, purchased electric energy, and contract work from the total value of shipments." Unit nonlabor charges include fringe benefits which accounted for about 7 percent of total employees' compensation in food and kindred products manufactures during 1957, according to the Bureau of the Census.



Growth Through Agricultural Progress

